2-1 Shapes of Function Graphs

In this chapter you'll learn ways to find a function to fit a real-world situation when the type of function has not been given. You will start by refreshing your memory about graphs of functions you studied in Chapter 1.

Objective

Discover patterns in the graphs of linear, quadratic, power, and exponential functions.

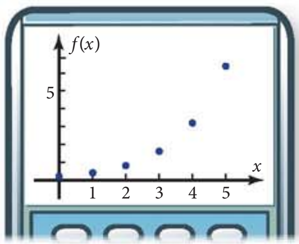

Figure 2-1a

Figure 2-1a shows the plot of points that are values of the exponential function $f(x) = 0.2 \cdot 2^x$. You can make such a plot by storing the x-values in one list and the $f(x)$-values in another and then using the statistics plot feature on your grapher. Figure 2-1b shows that the graph of f contains all the points in the plot. The **concave** side of the graph is up.

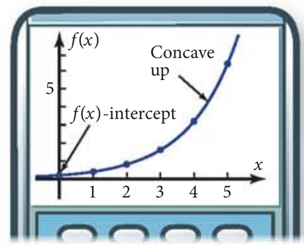

Figure 2-1b

Exploratory Problem Set 2-1

1. *Exponential Function Problem:* In the exponential function $f(x) = 0.2 \cdot 2^x$, $f(x)$ could be the number of thousands of bacteria in a culture as a function of time, x, in hours. Find $f(x)$ for each hour from 0 through 5. Plot the points, and graph the function as in Figure 2-1b. The number of bacteria is increasing as time goes on. How does the concavity of the graph tell you that the *rate* of growth is also increasing?

2. *Power Function Problem:* In the power function $g(x) = 0.1x^3$, $g(x)$ could be the weight in pounds of a snake that is x feet long. Plot the points for each foot from 0 through 6, and graph function g. Because the graphs of f in Problem 1 and g in Problem 2 are both increasing and concave up, what graphical evidence could you use to distinguish between the two types of functions? Is the following statement true or false? "The snake's weight increases by the same amount for each foot it increases in length." Give evidence to support your answer.

3. *Quadratic Function Problem:* In the quadratic function $q(x) = -0.3x^2 + 8x + 7$, $q(x)$ could measure the approximate sales of a new product in the xth week since the product was introduced. Plot the points for every 5 weeks from 0 through 30, and graph function q. Which way is the concave side of the graph, up or down? What feature does the quadratic function graph have that neither the exponential function graph in Problem 1 nor the power function graph in Problem 2 has?

4. *Linear Function Problem:* In the linear function $h(x) = 5x + 27$, $h(x)$ could equal the number of cents you pay for a telephone call of length x, in minutes. Plot the points for every 3 minutes from 0 through 18, and graph function h. What does the fact that the graph is neither concave up nor concave down tell you about the cents per minute you pay for the call?